

strongly under-arching hyaline cells.— Massachusetts, 16 Sept., 1891, leg. Faxon.

This species may be distinguished from *Sph. cuspidatum* by the very narrowly margined branch leaves, from *Sph. angustilimbatum* by much smaller stem leaves which are not fibrillose to the base, and which have the margins broadened below, as well as by the mostly three-branched fascicles with equally divergent branches.

FRIEDENAU, 25 Feb. 1908.

NOMENCLATORIAL CHANGES IN ISOËTES.— ISOËTES MACROSPORA Dur., var. **heterospora**, comb. nov. *Isoëtes heterospora* A. A. Eaton appears to be a form of *I. macrospora* Dur., endemic in streams and ponds on Mt. Desert Island. The vegetative parts of the two appear to be practically identical, differences being confined to the spores, which vary greatly in size and markings in the Mt. Desert plants. I therefore think it proper to reduce *I. heterospora* to the rank of a variety of *I. macrospora*.

I. DODGEI A. A. Eaton, var. **Robbinsii**, comb. nov. In compliance with Art. 49 of the Vienna Code the name *I. Dodgei* must be restored to the species designated by Engelmann as *I. riparia*, var. *canadensis* (*I. canadensis* A. A. Eaton), since it is the earliest name of the plant in its present rank. It becomes necessary, therefore, to change *I. canadensis*, var. *Robbinsii* to *I. Dodgei*, var. *Robbinsii*.— A. A. EATON, The Ames Botanical Laboratory, North Easton, Massachusetts.

A SOUTHERN FLORA AND FAUNA OF POST-PLEISTOCENE AGE IN ESSEX COUNTY, MASSACHUSETTS.

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THIS paper is the result of special studies upon a fossil or ancient marine molluscan fauna, collected in estuaries and bays on our coast, with a view to explaining the presence of certain plants of a southern flora found growing today in Essex County, Massachusetts, and elsewhere near the coast of New England. The data and conclusions of the paper may be stated under three headings.

I. A warm epoch is indicated by the presence in Essex County and in adjacent parts of New England of a southern flora which has become acclimated here and is apparently a survival from a warmer period. The most striking plants of this flora are enumerated below, and for sake of clearness the distance in miles from their stations north of Boston to the nearest known stations south of Boston is given.

<i>Names of Plants.</i>	<i>Stations north of Boston.</i>	<i>Interval in Miles¹</i>	<i>Nearest known Stations south of Boston.</i>
Sparganium lucidum Fernald & Eames.	Medford.	65	Barnstable, Mass.
Sagittaria Engelmanniana J. G. Smith.	Tewksbury.	80	Barnstable, Mass.
Echinodorus tenellus (Martius) Buchenau.	Winchester.	340	Canterbury, Del.
Scirpus Hallii Gray	Winchester.	1115	Indian River, Fla.
Fuirena squarrosa Michx.	Tewksbury.	50	Plymouth, Mass.
Scleria reticularis Michx.	Winchester.	40	Plymouth, Mass.
Betula nigra L.	{ Merrimac Valley, Pelham, N.H.; Lawrence; North Andover; Ipswich (rare).	115	Suffolk Co., L. I.
Magnolia virginiana L.	Essex and Magnolia Swamps, becoming nearly extinct.	120	Suffolk Co., L. I.
Crotalaria sagittalis L.	Cambridge, Winchester, Wake- field, etc.	40	Plymouth, Mass.
Linum sulcatum Riddell.	Peabody and Arlington.	40	Providence, R. I.
Ilex opaca Ait.	Rockport, where extinct since 1880.	36	Quincy, Mass.
Ilex glabra (L.) Gray.	Wenham and Magnolia Swamps, where the growing shrubs are rarely more than 2 feet high with stems $\frac{1}{2}$ inch in diameter.	30	Blue Hill Reserv. tion, Mass.
Ludwigia sphaerocarpa Ell.	Waltham, Bedford, Lowell, etc.	105	Guilford, Conn. & Suffolk Co., L. I.
Sabatia stellaris Pursh.	Amesbury and Salisbury.	50	Pembroke, Mass.
Cuscuta arvensis Beyrich.	Winchester.	90	Nantucket.
Cuscuta compacta Juss.	Tewksbury.	50	Lincoln, R. I.
Coreopsis rosea Nutt.	Winchester and Woburn.	40	Plymouth, Mass.

Professor W. G. Farlow, in the *Marine Algae of New England*, p. 6, writes "In the town (now city) of Gloucester, near the village of Squam, is a small sheet of water called Goose Cove. In this cove, to my surprise, I found *Rhabdonia tenera*, *Gracilaria multipartita*, *Chondria Baileyana*, *Polysiphonia Harveyi*, and *Polysiphonia Olneyi*. In short the flora was entirely different from anything I had ever seen before north of Cape Cod."

II. A warmer period is indicated in Essex County, Massachusetts, and in other parts of New England, by the finding on our coast of a fossil marine fauna such as is now known to inhabit the mud on the coast primarily south of Cape Cod, where the waters of the bays are much warmer than on the coast of Essex County. In deep digging for the foundation of the Boston and Maine Railroad bridge across Parker River in Newbury, the workmen came upon a large bed of

¹ These distances are in a direct line taken from Colton's Atlas.

shells of the oyster, *Ostrea virginiana*, many of which had both valves intact, showing that they had lived in the mud there. A few years later, in putting a new foundation for the railroad bridge at Rowley across Rowley River, still larger beds of shells of *Ostrea virginiana* were uncovered, some of which shells were 12 inches long by 3 inches wide. Upon an examination along the shore, I found extensive Indian shell heaps made nearly exclusively of these shells. Again, upon the working over of another Indian shell heap, on Perkins Island, Ipswich River, there were found large deposits of these shells, together with shells of *Venus mercenaria* (Quahog) and *Mya arenaria* (the common clam).

Recent investigations, in looking over the mud dredged from the bed of Bass River in Beverly, revealed shells of *Ostrea virginiana*, together with shells of *Pecten gibbus* L. var. *borealis*, *Astarte sulcata* and *A. undata* Gould, and *Pandora Gouldiana* Dall; also a coralline cluster of Bryozoans incrusting stones (*Schizoporella unicornia* Johnston, identified by Dr. Bassler of the National Museum). These cluster-colonies completely covered stones six inches long and three inches broad and were built up nearly half an inch thick. In washing the mud I collected many thousands of shells of Foraminifera of several species.

A few feet below the living fauna, in the muddy bottom of Danvers River, near the new bridge connecting North Salem with Beverly, I found another large bed of the shells of *Ostrea virginiana*, together with numerous shells of *Pecten*. Shells of *Astarte undata* were also abundant; and shells of *Anomia glabra* Verrill, of great size, one of them three inches in diameter, with many other species, were thickly scattered among them. Shells of *Venus mercenaria* (Quahog), some of which measured four and a half by three and a half inches, were common. Several species of coralline clusters of Bryozoans, including *Schizoporella* sp. and *Escharella variabilis* Verrill, were found.

The fauna represented by the above species, from these various stations in Essex County, is now known to live south of Cape Cod, where the Gulf Stream flows nearer the coast thus giving a much warmer climate. This indicates that there must have been a similar warm climate on the coast of Essex County, when this fauna flourished here and elsewhere north of Cape Cod — on the coast of northern New England and probably in the Bay of Fundy and the Gulf of St. Lawrence; and as these shell fish, *Ostrea virginiana*, *Venus mercenaria*,

etc., were used by the Indians as food, they must have lived here in our tidal estuaries and harbors until modern times.

III. The warm epoch along the coast of Essex County and northern New England is explained by an elevation of the land in New England and adjacent regions which followed the Champlain subsidence. At the end of the Champlain subsidence the land on our coast had become submerged to a depth of 360 or more feet, as pointed out in the Physical Geography and Geology of Essex County.¹ After the Champlain subsidence the land was again elevated, as is proved by the finding of fossil shells of *Portlandia arctica* Gray, *P. lucida* Loven, and other species of Arctic mollusks, together with the hard parts of a large starfish, *Asteracanthion Lincki* Muhler, in the clay beds at about the present sea level in Danvers and Lynn, Essex County, Massachusetts; for at present the above species of *Portlandia* are taken alive on the coast of Norway only at a depth of from 360 to 500 feet. Judging from the rate of the subsidence now going on,² about one foot in a century, this elevation of 360 or more feet must have taken approximately 36,000 years. In the course of this elevation at the North, the Straits of Belle Isle must have become land locked,³ thus forcing the Labrador current, with its cold waters and icebergs, to join the Greenland current in its northward flow. This closing of the Straits of Belle Isle allowed the warm waters of the southern seas to come into Cape Cod and Boston Bays. Under such conditions the climate of Essex County and northern New England must have been similar to the climate of southern New England, and probably to that of the New Jersey coast; and a warm epoch continued here probably for a long time. During this epoch the fauna previously described, of *Ostrea*, *Pecten*, etc., was introduced and multiplied in our waters; and as the land emerged above the waters the southern flora took possession of it. Some of the plants of that southern flora, as previously noted, have survived to the present time, according to situation or environment, and have become acclimated.

Professor James D. Dana writes "On the coast of Maine there are large Indian shell heaps of the common clam, *Venus mercenaria* (the Quahog of the Indians) and, in some places, of the Virginia Oyster, species that are now nearly extinct on the cold coast. As made known by Verrill there is a colony of living southern species in Quahog Bay,

¹ Sears, Phys. Geogr., Geol. etc. of Essex Co. 373. (1905).

² See Sears, l. c.; Chapter on Subsidence, p. 58.

³ At the present time an elevation of 200 feet would close the Straits of Belle Isle.

near Bath, twenty miles east of Portland, among which are *Venus mercenaria*, and others, reminding one, as Verrill says, of the coast fauna of New Haven, on Long Island Sound. Shells of oysters, clams, and scallops (the southern *Pecten irradiens*) are abundant in the deeper portions of the mud of the harbor of Portland. As with the flora, so with the fauna, certain species are found to-day, living in protected situations." ¹

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NOTES ON SOME PLANTS OF NORTHEASTERN AMERICA.

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DURING studies upon various North American plants the attention of the writer has been called to several northeastern species, varieties, and notable forms which are either undescribed or are now passing by names which they cannot retain under the international rules adopted at Vienna. Most of these plants are of such diverse affinities as to furnish slight thread for a continuous discussion, and the notes upon them have, therefore, been allowed to accumulate. As the number of these notes is now considerable they are here presented that they may be more readily available.

POTAMAGETON **bupleuroides**, n. sp., caulibus gracilibus 1-2 mm. crassis 3-7 dm. longis plerumque ramosissimis rectis, internodiis brevibus 0.5-1.5 (raro ad 3) dm. longis; foliis planis fulvis valde unicos-tatis nerviis lateralibus 6-16, superioribus orbicularibus vel ovatis obtusis basi amplexicaulibus 1-3 cm. longis, inferioribus ovatis vel lanceolatis obtusis vel subacutis 2.5-4.5 cm. longis; stipulis obsoletis vel nullis; pedunculis gracilibus 2-6 cm. longis; spicis 0.7-2 cm. longis; fructibus anguste obovoideis 2.5-3.2 mm. longis lateraliter compressis valde impressis dorso convexo obscure carinato, stylo gracili, epicarpo olivaceo-fulvo arcte contento. — Stems slender, 1-2 mm. thick, not spongy, 3-7 dm. long, simple below, usually much branched above,

¹ Dana Manual of Geology, 561.